

Renewable Capacity Kotzebue Electric Association Inc.

**Brad Reeve
Kotzebue Electric Association**



Kotzebue Electric Association

The background image shows a harbor scene. In the foreground, a small white boat is docked at a pier. A large crane is visible in the background, and several buildings are situated along the waterfront. The sky is overcast.

- Stand alone utility system
- Received our 1st REA Loan 1953
- First generated power in 1954
- First wind turbines operational in 1997
- Started wind program to reduce diesel consumption

Kotzebue, Alaska

A Unique and Difficult Environment

- Low, flat terrain consisting of tundra and permafrost
- Annual average temperature -5.8°C (22°F)
- Average snowfall – 127 cm (4.2 feet)
- Winter wind-chill temperatures reach -100°F
- Kotzebue Port is ice free for $3\frac{1}{2}$ months

KEA Wind Program

- 1991 – Received a Research Grant from NRECA Rural Electric Research for Power Quality with Wind Resource (\$25,000)
- 1992 - Established wind monitoring program using KEA and State Funding
- Could not find a company willing to work in the Arctic after several years found a Vermont company willing to work in Alaska (AOC)
- 1993 – KEA Board Committed \$250,000 to develop a wind project

Obstacles to Development

- Lack of adequate wind resource data
- Few manufacturers of wind equipment suitable for rural Alaska
- Lack of transmission to areas with good wind resource
- Transportation issues i.e. cost, remoteness
- Utility involvement
- Cold weather design features
- There was no supporting infrastructure
- Early equipment wasn't ready for Alaska

KEA Wind Program

- 1993 State of Alaska committed a match to KEA funds, this gave us enough funding to buy 3 turbines
- 1994 - Signed land lease with village corporation
- 1996 - Ordered 3 turbines
- 1998 - Became an associate Turbine Verification Program (TVP) US Department of Energy this helped open doors to research assistance
- 1998 - KEA received a Sustainable Technology Energy Program (STEP) grant which purchased 7 more turbines to be tested for cold weather deployment

KEA Wind Program

- 2002 - Installed 1st Commercial North Wind 100 kW partly funded by the National Science Foundation for cold weather testing for South Pole deployment
- 2010 - KEA awarded State of Alaska - Renewable Energy Fund grant leveraged into a \$11 million project using \$3 million Clean Renewable Energy Bond (CREBS) for increased wind capacity and storage
- 2012 Installed 2 EWT 900 kW – wind turbines
- Project also used funding we had from other grants to develop the storage component

2,940 KW Potential Wind power

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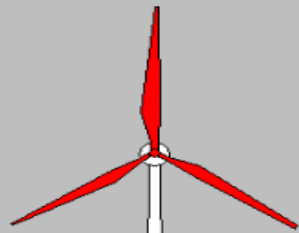
Wind Overview

Wind KW

Wind KVAR

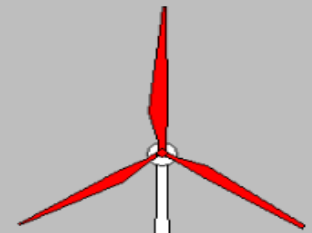
1020

-133



WT 18

447.3 Kw
3 Kvar



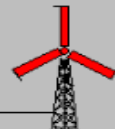
WT 19

353.4 Kw
8 Kvar



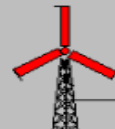
WT 01

15.3 Kw



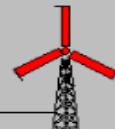
WT 02

-0.2 Kw



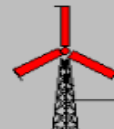
WT 03

13.6 Kw



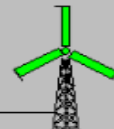
WT 11

19.3 Kw



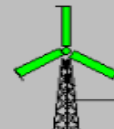
WT 04

10.8 Kw



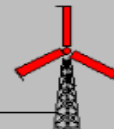
WT 05

0.0* Kw



WT 06

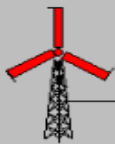
0.0* Kw



WT 07

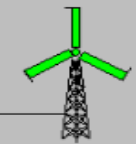
11.0 Kw

Feeder 4



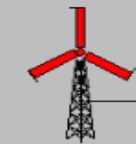
WT 08

17.6 Kw



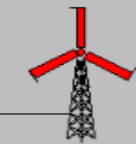
WT 09

0.0 Kw



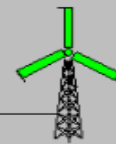
WT 10

18.8 Kw



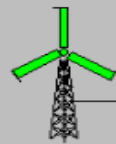
WT 12

18.6 Kw



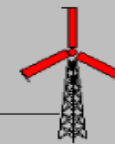
WT 14

0.0* Kw



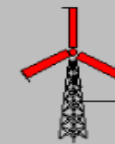
WT 13

0.0* Kw



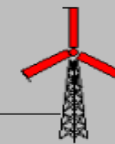
WT 15

16.0 Kw



WT 16

11.2 Kw



WT 17

19.8 Kw

09/11/13 08:10:55 HMI - WT05 PLC COMMUNICATION FAILURE
 09/11/13 08:11:05 HMI - DS02 PLC COMMUNICATION FAILURE
 09/11/13 08:11:05 HMI - DS03 PLC COMMUNICATION FAILURE
 09/11/13 08:23:03 WIND - WIND TO MSTR PLC COMM FAIL
 09/11/13 08:23:34 MSTR - MSTR TO WIND PLC COMM FAIL

Sys 2570
 Freq 59.99

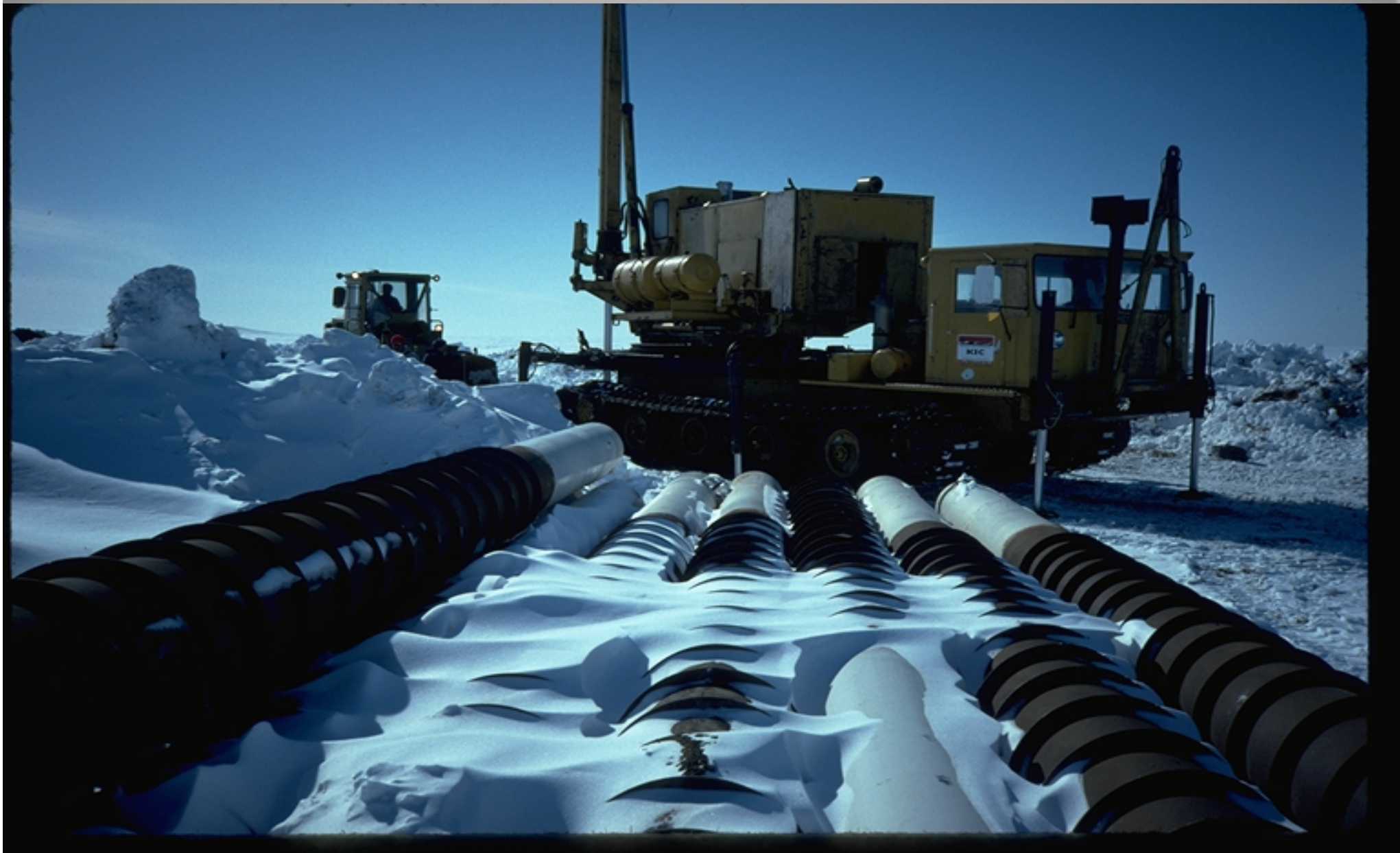
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 Primary: NOT SET
 Function: Ctrl Only
 User/Level: Administrator / 9999

09/11/2013 08:28:14
 Remote: kmast
 IP: 10.100.200.97
 Legend
 Log Off
 Ver 10.3

Early Project Construction



Arctic Foundations



Tilt Up Towers





Early tilt up design



Northwind 100

**Northwind 100
installed April
2002**

**Rated Capacity
100 kW**



Larger turbines/new solutions



Foundations



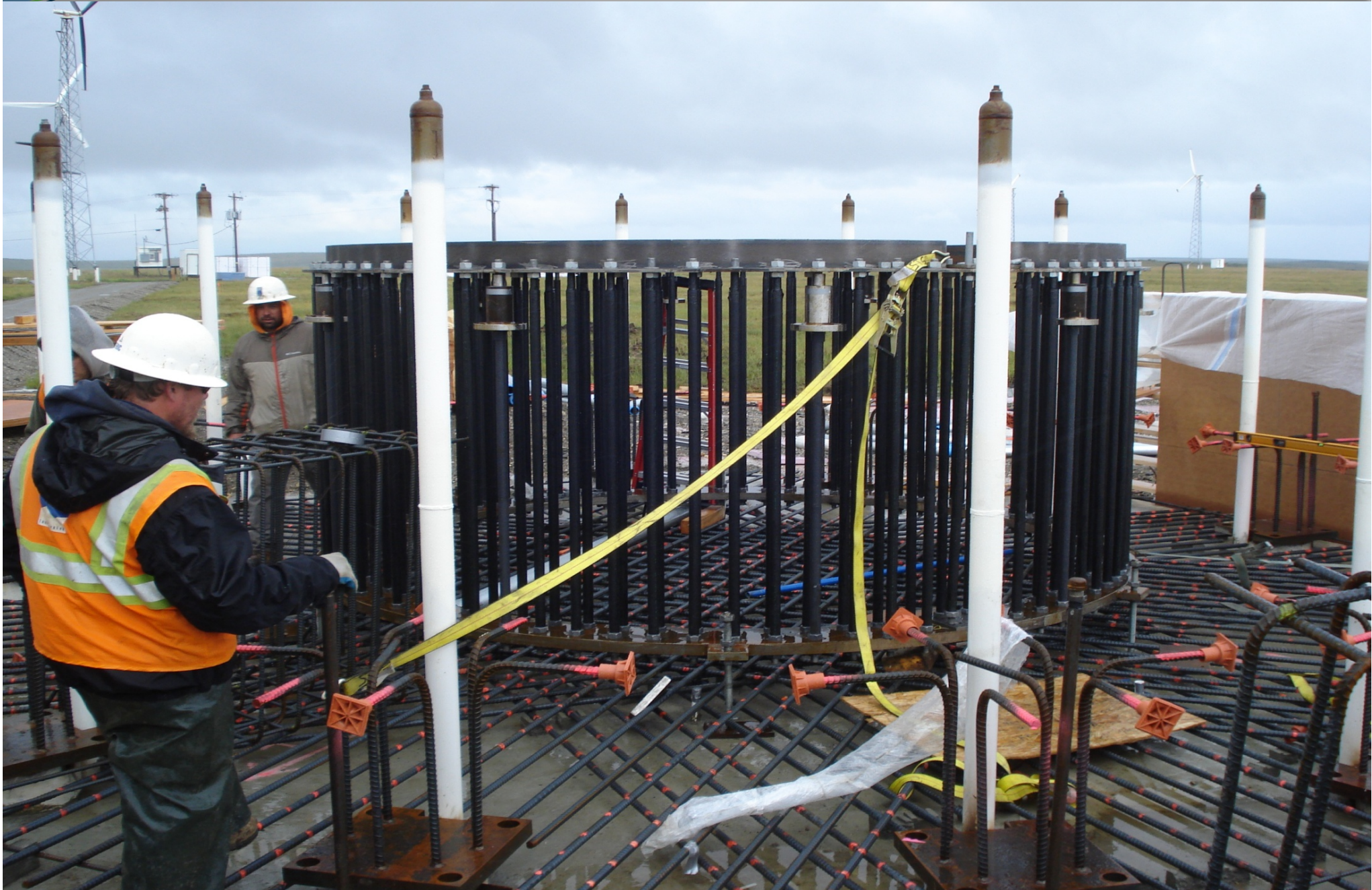
Foundations



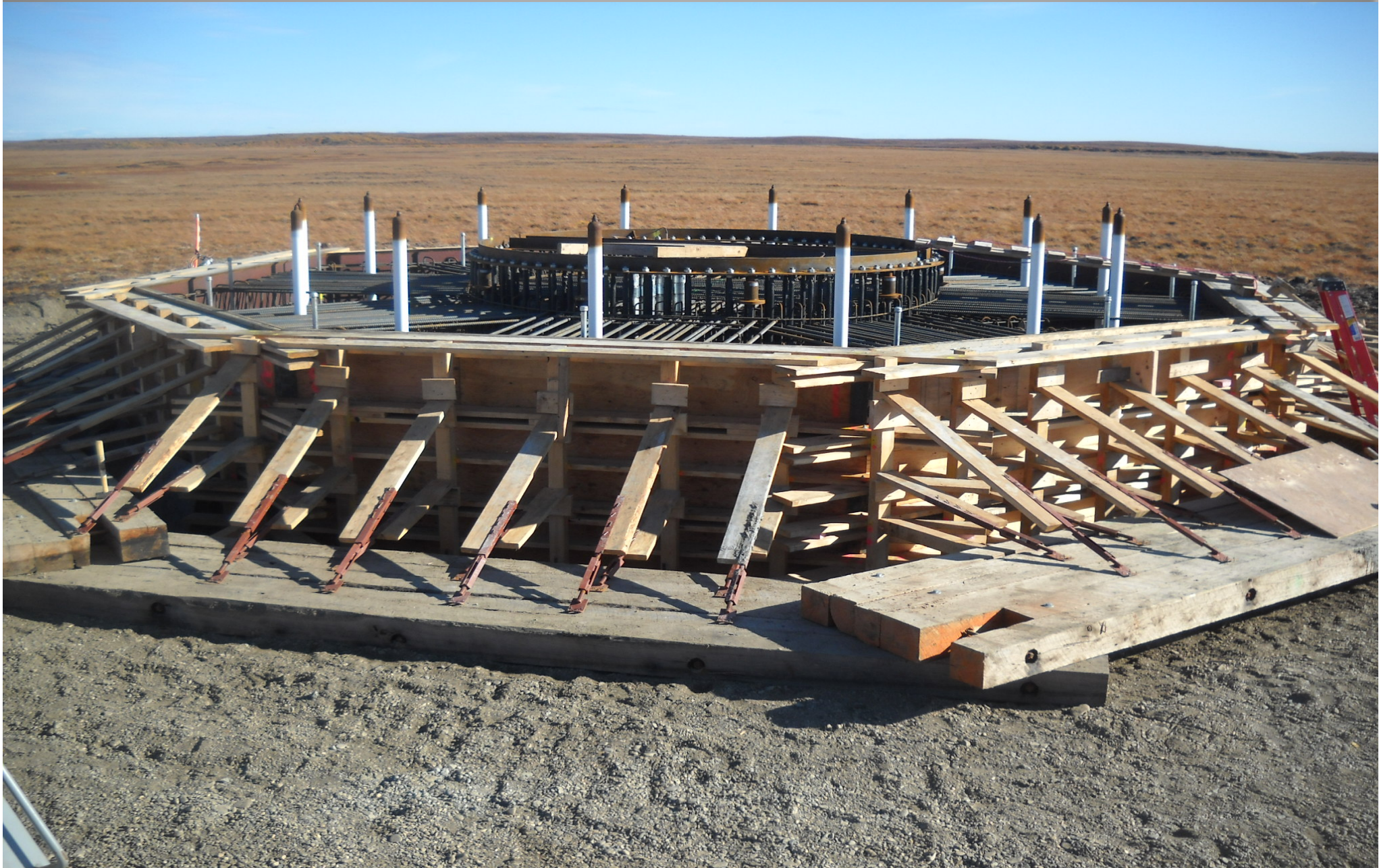
Foundations



Foundations



Foundations



Logistics



Logistics



Construction



Construction



New Turbine Generator



Construction



Construction



Soft Extreme Temperature Battery Energy Storage System (BESS)

- Commissioned in December 2015
- After 8 years of trying we finally had a functioning battery
- The battery store excess wind energy, reduces outages, and is reducing diesel usage



Soft Extreme Temperature Battery Energy Storage System (BESS)

- The battery acts like another generator and keeps peaking units offline
- We believe the battery will save 75-90k gallons annually



ABB Statcom (provides grid stability)

Allows more
wind on system

Funded by
NRECA/DOE
Smart Grid Grant



GE Clean Cycle

Uses Exhaust Heat
to make power,
anticipated
reduction in diesel
50,000 gallons per
year



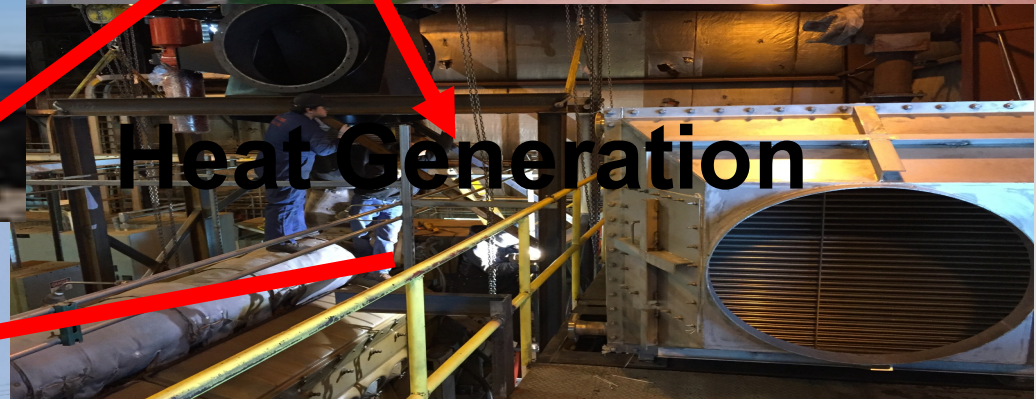
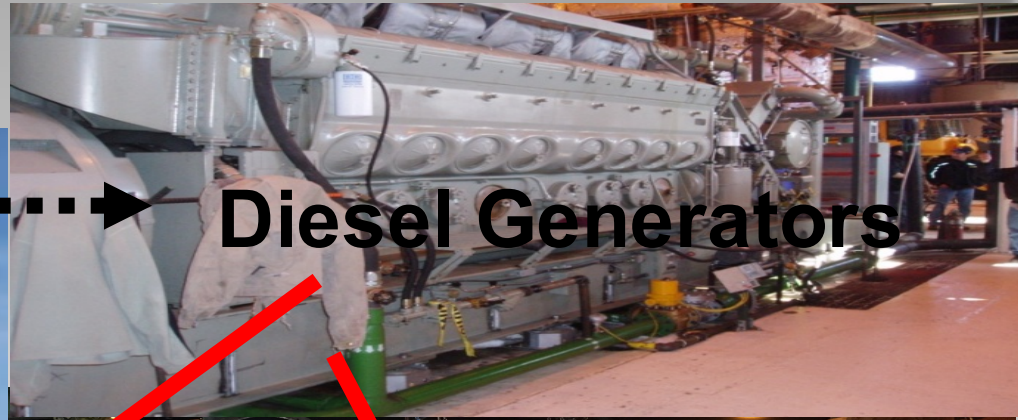
Excess Wind Heats Hospital

500 kVa
Transformer
delivers excess
wind energy to
a thermal boiler
at hospital





Wind-Battery-Diesel-ORC Hybrid Project



Future Capacity

- Involving our schools
- Education Curriculum
- Community Involvement
- Sharing Lessons Learned



Thank You

